Brown Bag Series

VOCs

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Maricopa County
Air Quality Department

Public Outreach & Training

The Air Quality Department, while being a regulatory agency, puts a great deal of effort into educating the public and sources about the regulations.

- Compliance Assurance Model
- Education
- Permitting (business) assistance and
- Maintaining compliance
- Training

Outline

- VOCs = Volatile Organic Compounds
- What Are They?
- Why Do They Receive So Much Attention?
- Basic Concepts – Sources and Effects
- Definitions
- Regulations associated with VOCs
- Calculations – Content and As Applied
- How Can We Help Each Other

CLEAN AIR MAKE MORE

WALK MORE USE CFLS MORE
ERRANDS MORE RIDE PUBLIC
MORE CONSIDER SOLAR MORE
REDUCE WOODBURNING MORE
MORE RIDE THE BUS MORE

Contributors to VOCs

BIKES MORE CONSOLIDATE
REUSABLE TOTE BAGS
CONSERVE ELECTRICITY MORE
REFUEL AFTER DARK
BIKE MORE RAKE MORE

Biogenic

(Natural Sources)

- Trees
- Vegetation

Anthropogenic

(Man Made)

- Automobiles Exhaust
- Manufacturing facilities
- Paint Shops
- Power Generating Plants
- Fossil fuel combustion

Criteria Pollutants

Air Pollutants Proven to be a Public Health Hazard:

- Particulate Matter – 10 & 2.5 microns
- Sulfur Dioxide SO2
- Carbon Monoxide CO
- Nitrogen Oxides NOx
- Lead
- Ozone

Where is the VOC….?!!

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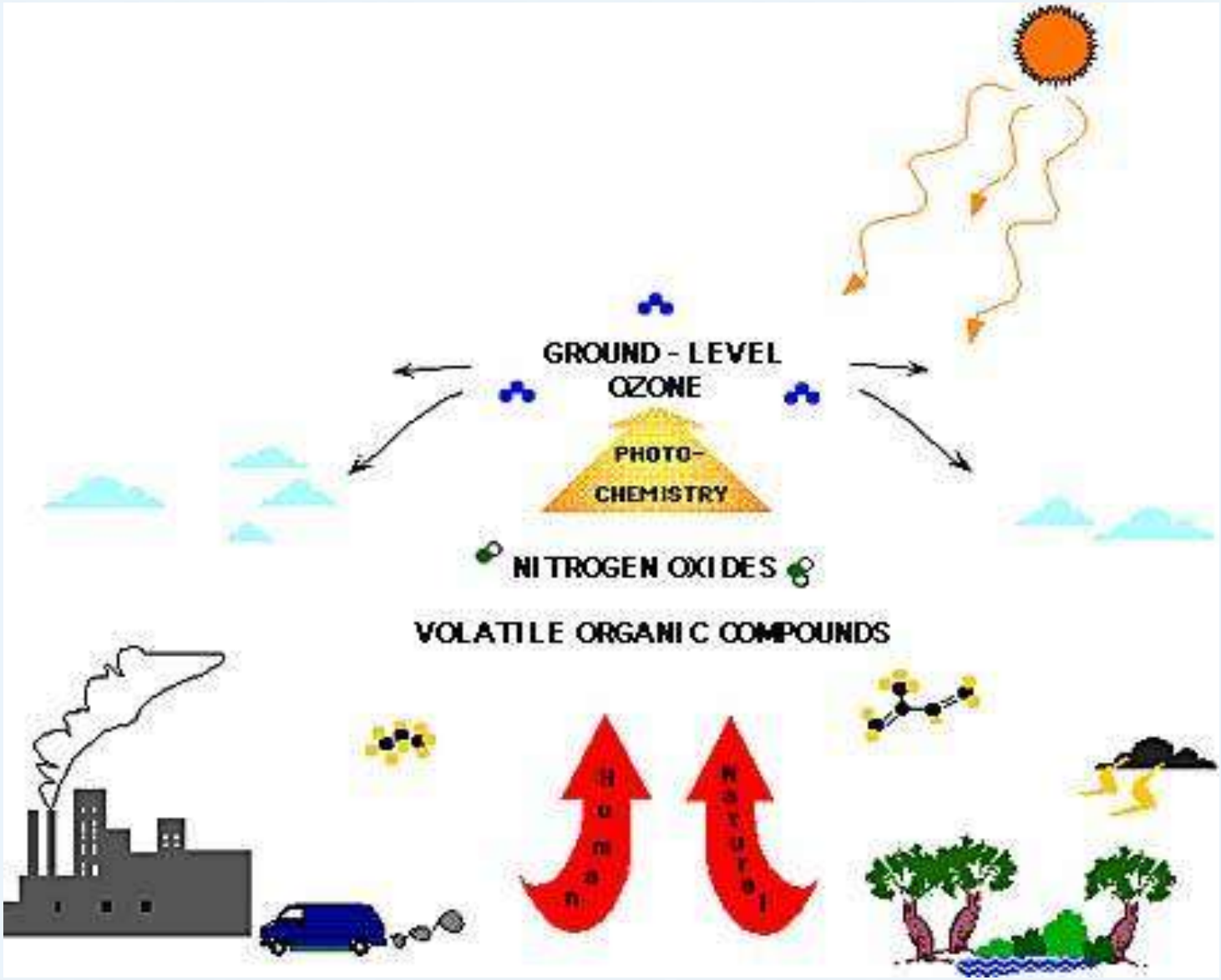
How Ozone is Formed



VOCs & Ozone

- UPPER atmosphere ozone protects us from the sun's dangerous UV rays. Ground level ozone is quite the opposite. It has adverse effects on human health.

- GROUND level ozone is a difficult to control because it is NOT emitted into the air, but is actually FORMED in the atmosphere. It is a highly reactive gas that affects the normal function of the lung in many healthy humans.

Why do we care about VOCs

- Volatile Organic Compounds (VOC) are one of the compounds that are involved in a chemical reaction in the presence of sunlight that produces ozone.
- VOC is an ingredient/precursor

VOC + NOx + sunlight = OZONE

Nitrogen Oxides (NOx)

- NOx is a generic term for a group of highly reactive gases, which contain nitrogen and oxygen in varying amounts.

- Many of the nitrogen oxides are colorless and odorless.

- One common pollutant, nitrogen dioxide, (NO_2) along with particles in the air can often be seen as a reddish brown layer over many urban areas.

Effects of Ozone

Humans

- Breathing in ozone can trigger a variety of health problems including chest pain, coughing, congestion. Ground level ozone can reduce lung function and inflame the linings of the lungs.

Plants

- Reduce yield of agricultural crops and damage forests and other vegetation.

Ozone effects on plants

Ambient ozone injury to sensitive and tolerant snap beans

Ozone injury in a pumpkin leaf

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BUGS MORE CONSOLIDATE
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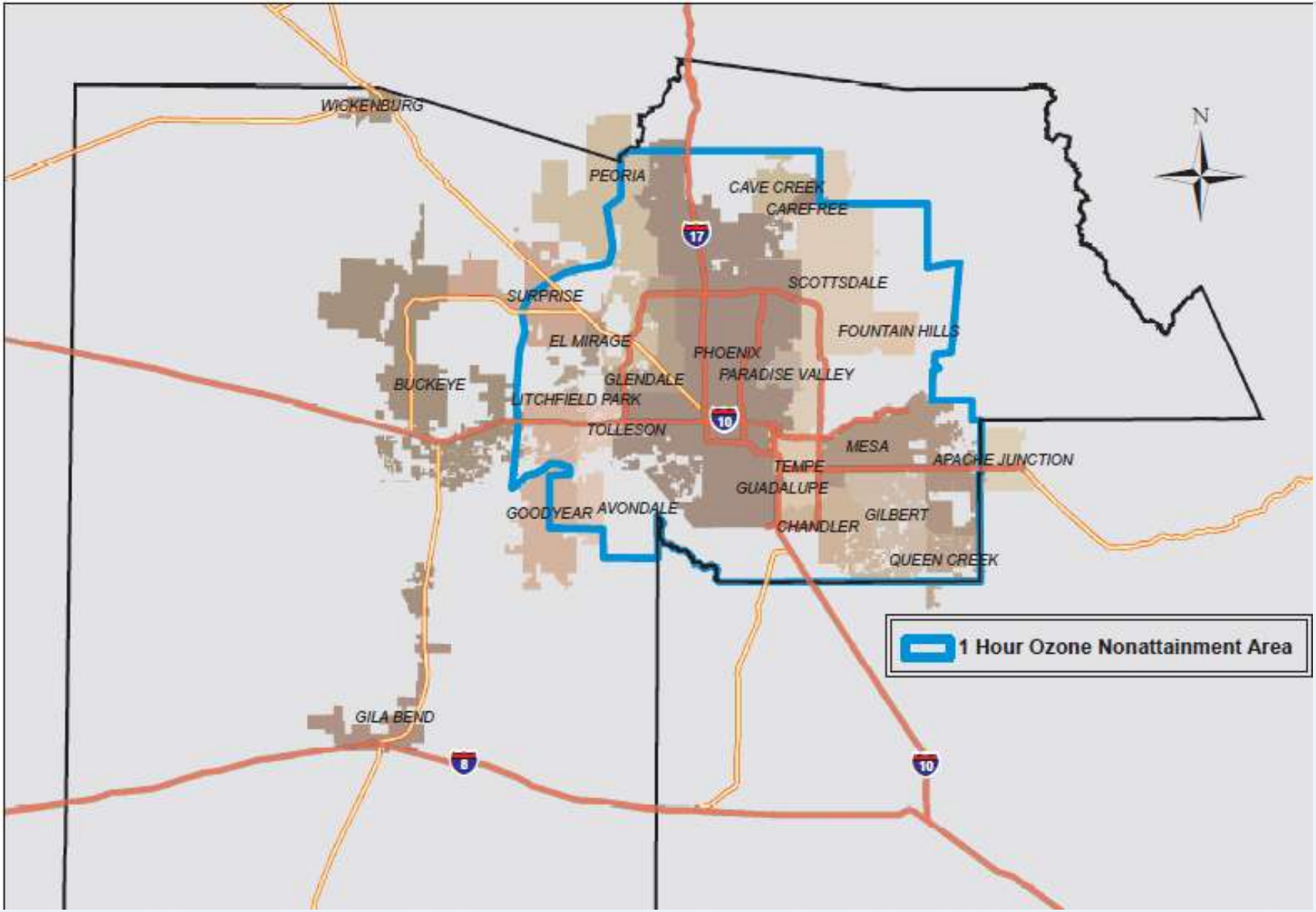
Ozone Non-Attainment



CLEAN AIR MAKE MORE

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ERRANDS MORE RIDE PUBLIC
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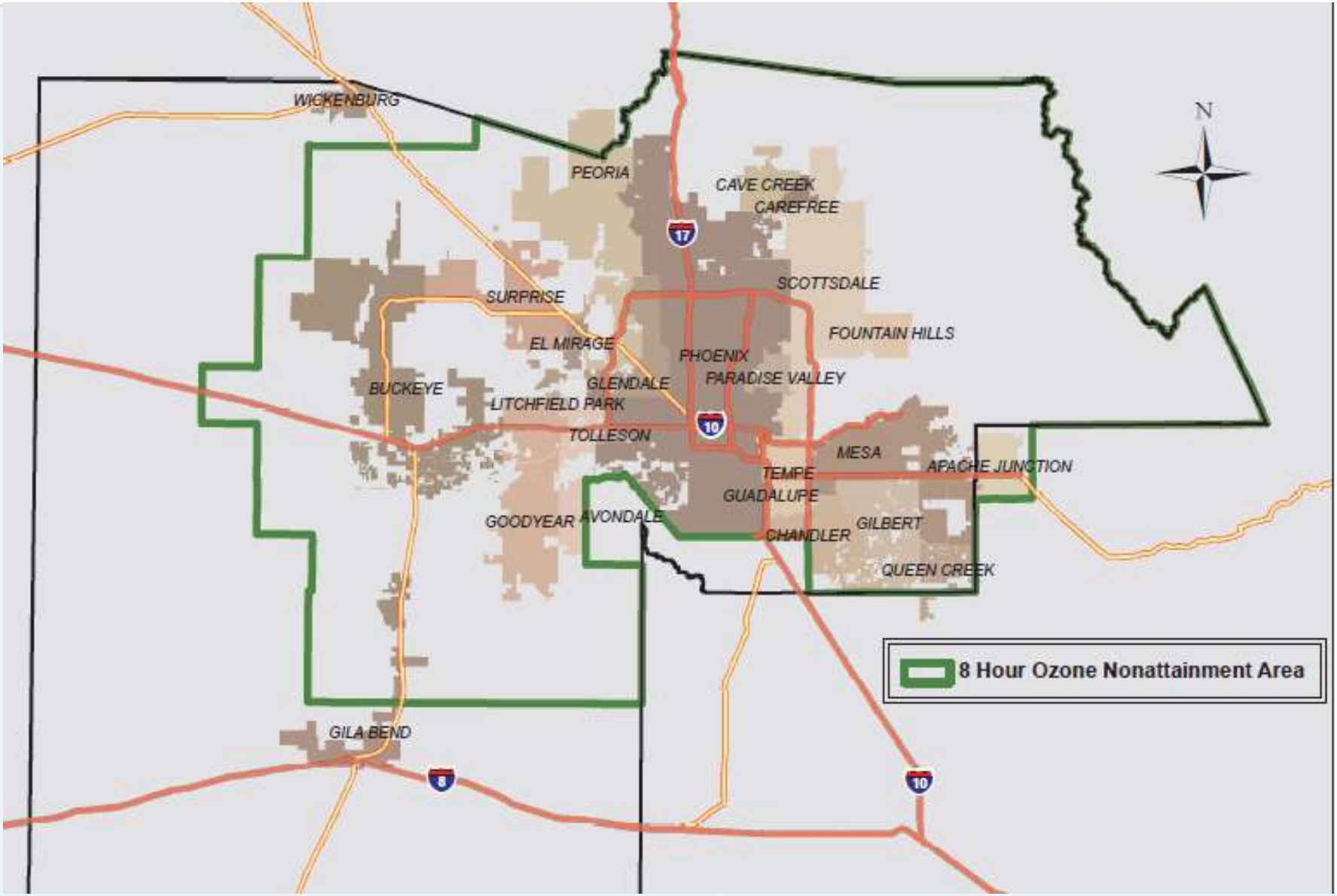
BUS MORE CONSOLIDATE
USE REUSABLE TOTE BAGS
DRIVE ELECTRICITY MORE
REFUEL AFTER DARK
BIKE MORE RAKE MORE

Ozone Non-Attainment



Non-attainment

What is the implication of this classification?

Under the Clean Air Act (CAA), we are required to reduce emissions each year until the national standard is met. To achieve the CAA national standards and reach ground level ozone attainment levels, virtually **all sources of man-made VOC emissions** are regulated, including solvent uses.

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County rules related to VOCs

- Rule 315: Spray Coating Operations
- Rule 330: Volatile Organic Compounds
- Rule 335: Architectural Coatings
- Rule 336: Surface Coating Operations
- Rule 337: Graphic Arts
- Rule 342: Coating Wood Furniture & Fixtures
- Rule 345: Vehicle & Mobile Equipment Coating
- Rule346: Coating Wood Millwork
- Rule 348: Aerospace Manufacturing & Rework Operations

Why Do We Care About Coatings?

Every type of paint (liquid, and YES, even in powder coating) contains two kinds of components, that ends up in two different places:

- The parts we want (the solids) end up on what we are painting (the substrates) and

- The rest (the liquids, or volatiles) end up in the air.

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VOC Exempt Solvents

All VOCs are NOT Alike

- Do not contribute equally to the ozone problem; some react rapidly and some are relatively inert
- Only a few are non-VOC containing materials
  - i.e.: acetone and PCBTF (p-chlorobenzotrifluoride)
- Product formulators must consider the properties of these non-exempt solvents in a formulation, not just whether they are VOC exempt

Ozone Forming Potential

Mass Based Approach-traditional

Limiting the mass percentage of VOCs in products or formulation

VOCs are either considered reactive (and therefore subject to VOC regulations) or Negligibly reactive and thus exempt from the regulation

This approach treats all non-exempt VOCs alike in their ability to contribute to ozone levels.

Ozone Forming Potential

Photochemical Reactivity Approach

Provides the ability to differentiate between more reactive and less reactive VOCs.

Controls of VOCs in this manner should:

- Lead to a higher reduction in ozone creation potential in a more efficient, cost effective, and expeditious manner

- Increase formulation flexibility, and maintain/improve product performance

Methods for Determining VOC Content of Paints & Coatings

1) Pounds/gallon (lbs/gal)

$$VOC = \frac{\text{pounds of solvent - exempt solvent}}{\text{gallons of coating - exempt solvent}}$$

2) Pounds/pound (lbs/lbs)

$$VOC = \frac{\text{pounds of solvent-exempt solvent}}{\text{pounds of solids}}$$

1) pounds/gallon (lbs/gal)

- More widely used

2) pounds/pound solids (lbs/lbs)

- Considered better because it measures the expected VOC emissions for a given amount surface area coated to a given film thickness

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	Coating Containing NO VOC EXEMPT solvent	Coating Containing VOC EXEMPT solvent
Weight of Coating, lbs	100	100
% of Non Volatile Matter (solids)lbs	15	15
Total Coating Volume, Gallons	13.3	13.2
Total Weight of Solvents, Pounds	85	81
Weight of VOC-EXEMPT solvent, lbs	0	32
Volume of VOC-EXEMPT solvent	0	4.9
VOC content Calculates per :		
Method 1		
lbs of solvent -exempt solvent	85 lb- 0 lb	81 lb-32 lb
gallons of coating-exempt solvent	(13.3 - 0) gal	(13.2 - 4.9)gal
lbs VOC/gal=	6.39	5.90
Method 2		
pounds of solvent-exempt solvent	85-0	81-32
pounds of solids	15	15
lbs of VOC/lb solid	5.67	3.27

VOC Limits for Coatings as Applied

- Is the primer/ basecoat/ clearcoat going to be mixed with some type of reducer before it gets sprayed onto a substrate?
- What is the manufacturer's suggested mix ratio?
- Does the mix ratio remain the same year round or seasonal; winter versus summer?

Mix ratio to Determine Allowable VOC

Spot jobs

Recommended ratio is 1:1(Primer:reducer)

Ex: 1. Primer:Reducer (1:1 ratio)

Per MSDS, Primer VOC lbs/gal:=3.43;

Per MSDS, Reducer VOC lbs/gal=6.64

(3.43 + 6.64)/2 = 5.03 lbs/gal

Mix ratio to Determine Allowable VOC

Single/2 stage topcoats: Limit= 5.0 lbs/gal

Ex: 2. Clearcoat:Hardener:Reducer (4:1:1)

Per MSDS, Clearcoat VOC lbs/gal = 5.2;

Per MSDS, Hardener VOC lbs/gal=3.41

Per MSDS, Reducer VOC lbs/gal=4.00

Note total of gallons: 6

4 (5.2 lbs/gal) + 3.41 lbs/gal + 4.00 lbs/gal

=(20.8 + 3.41 + 4.00) divided by 6

= 28.21/6

= 4.7 lbs/gal (a compliant product)

Tips To Reduce Ozone Pollution

- Drive less. When possible, carpool or use public transportation.
- Avoid waiting in long drive-thru lines, for example, at coffee shops, fast-food restaurants or banks. Park your car and go inside.
- Re-fuel your vehicle in the early morning hours or after dark during cooler hours.
- Use low-VOC (Volatile Organic Compounds) or water-based paints, stains, finishes, and paint strippers.
- Delay painting projects until high pollution advisories have passed.
- Make sure that containers of household cleaners, garage and yard chemicals, and other solvents are sealed properly to prevent vapors from evaporating into the air.
- Conserve electricity.

Information & Resources

- To report an air quality problem:
  - Call 602-372-2703
    OR
  - File a report online at: www.maricopa.gov/aq
    "Report a Violation"

- Sign up to receive pollution advisories
  - www.CleanAirMakeMore.com "Make the Commitment"

- Small Business Assistance contact:
  - Ken Hooker
  - 602-506-5102
  - khooker@mail.maricopa.gov

Thank You

Any Questions?

CLEAN AIR
MAKE
MORE

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WALK MORE USE CFLS MORE CARPOOL MORE BIKE MORE RAKE MORE TELECOMMUTE MORE DRIVE HYBRIDS MORE CONSOLIDATE ERRANDS MORE RIDE PUBLIC TRANSPORTATION MORE USE ENERGY EFFICIENT APPLIANCES MORE CARRY REUSABLE TOTE BAGS MORE CONSIDER SOLAR MORE RUN COLD WATER CYCLES MORE USE REUSABLE CONTAINERS MORE CONSERVE ELECTRICITY MORE REDUCE WOODBURNING MORE RECYCLE MORE REFUEL AFTER DARK MORE RIDE THE BUS MORE RIDE THE LIGHT RAIL MORE USE CFLS MORE